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whose work continues, consists of W. M. Davis and Cyrus C. Adams. On the sub-committee were appointed Cyrus C. Adams, J. Paul Goode and Ellen C. Semple.

Officers elected for the following year are: President, G. K. Gilbert; First Vice-President, R. D. Salisbury; Second Vice-President, Ellen C. Semple; Secretary, A. P. Brigham; Treasurer, N. M. Fenneman; member of Council for three years, R. S. Tarr.

The following new members were elected: Rowland M. Harper, College Point, N. Y.; Philip Sidney Smith, U. S. Geol. Survey; William Lawrence Tower, Chicago; Lawrence Martin, Madison, Wis.; and Eliot Blackwelder, Madison, Wis.

It was all but formally decided that the fifth annual meeting will be held at New Haven under the auspices of Yale University.

THE RAIYAN CANAL.

At the December meeting, 1907, of the Khedivial Geographical Society, Sir William Willcocks, formerly Director-General of Reservoir Studies, urged the Egyptian Government to proceed at once with the execution of the Raiyan Canal, repeating the assurances of its feasibility and value previously made by him. It was described by him in his work "Irrigation in Egypt" (1889); and, in 1904, in his lecture delivered before the same Society, in Cairo, entitled "The Assuan Reservoir and Lake Moeris." On that occasion he said: "There is no more complete and perfect project before the world to-day than this combined reservoir and lake project. To the imagination, it affords one of the most fascinating views which the mind of man can conceive. Viewed from its humanitarian side, it is equally attractive." This subject was first presented to the American Geographical Society at a special meeting in October, 1882. The details of the repeated examination of the Fayoum Basin, and the discovery by Mr. Cope Whitehouse of the Wadi Raiyan, which occupies the place of the Lake Moeris on the Ptolemaic maps, were printed in the BULLETINS of this Society (1882 and 1889). The subsequent efforts of the author of this project to overcome the unexplained opposition of the English officials, in the Ministry of Public Works, to the advice of their own expert are set forth at some length in a Senate document (No. 104, January, 1906). It will be remembered that M. Linant de Bellefonds, the famous chief-engineer of Mehemet Ali and his successors, Abbas, Saïd and

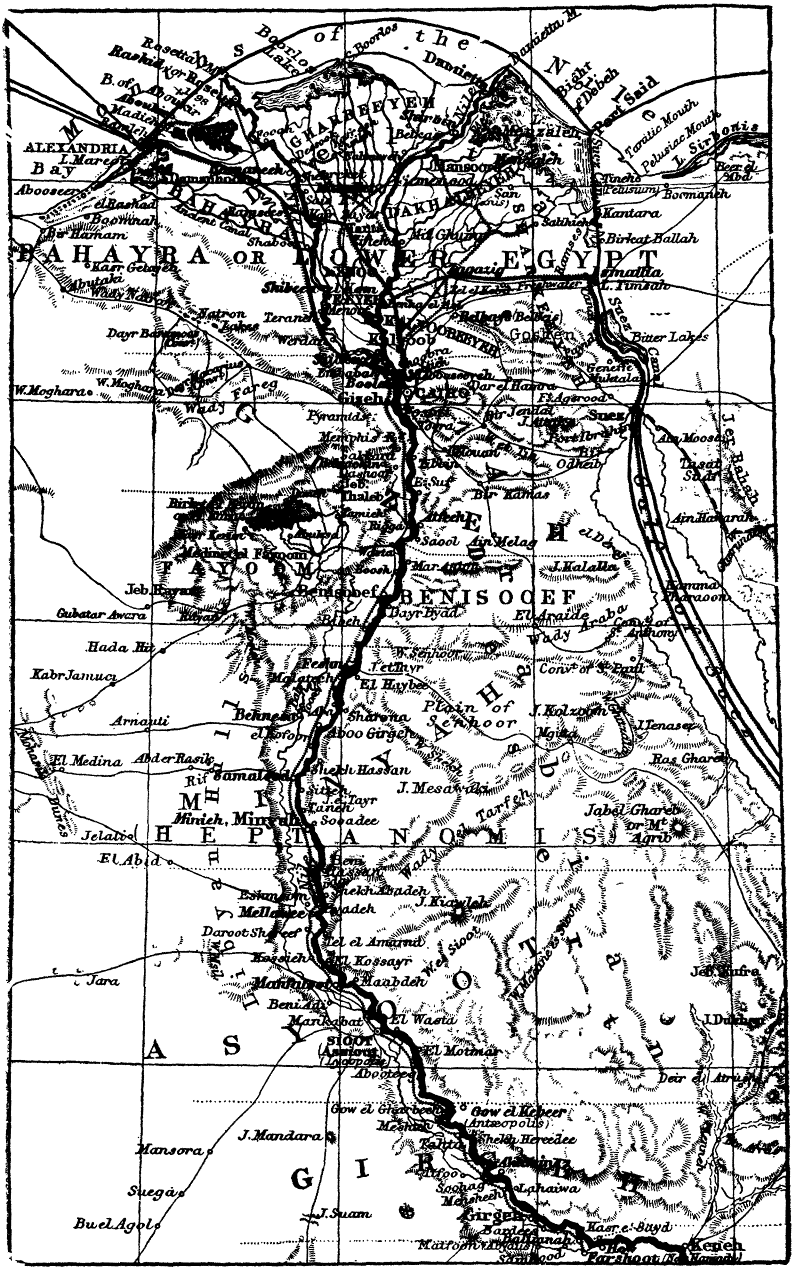

FIG. 1—MAP OF EGYPT. (LENT BY MR. FRANK C. CLARK.)

Ismail, had informed the cartographers that the Desert to the south of the Fayoum was higher than the Nile. Therefore, the map drawn for Dr. Lepsius was followed by all the geographers prior to 1882, when it was asserted by Mr. Cope Whitehouse, on evidence which was presented, in 1883, to the Khedivial Geographical Society, that there was in fact an area of about 250 square miles, not

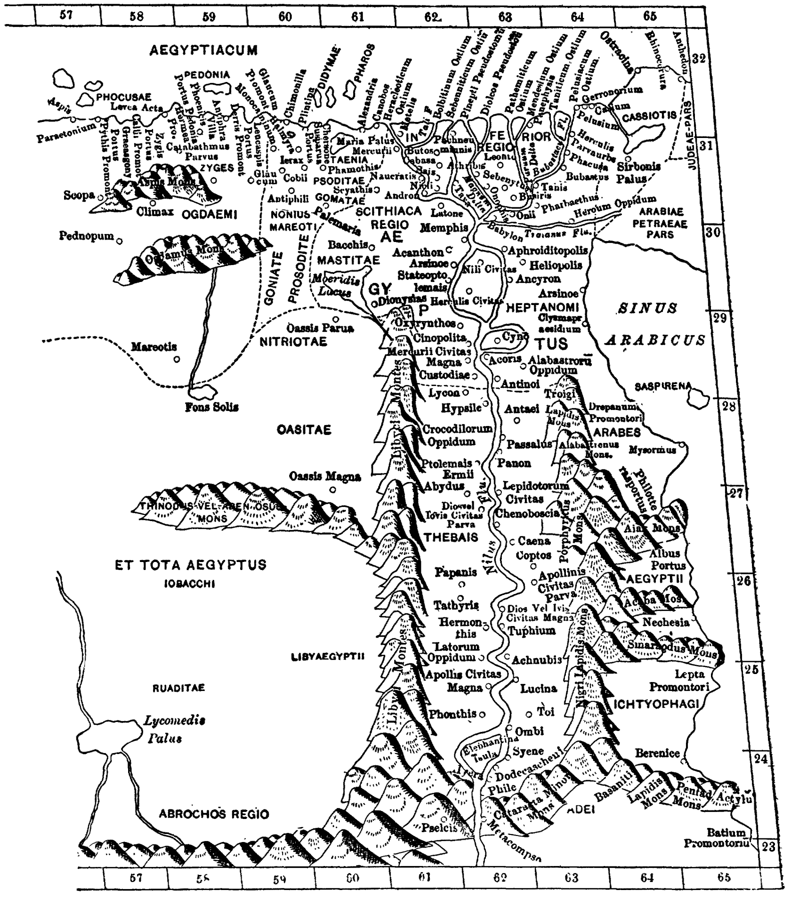

FIG. 2—ANCIENT EGYPT. FROM THE MAP IN THE PTOLEMY OF 1508.

unlike the Salton Sink in its depth, at all events, below the level of the Nile; and that its lowest part was 120 feet below the Mediterranean. It is, therefore, capable of acting as a flood escape; and as a reservoir, without pumping, through the utilization of the difference of about 20 feet between High and Low Nile at the mouth of the Canal, which would serve as intake and outlet. The total contents of the reservoir have been determined to be 22,000 million cubic meters. The available water supply would be well in excess of 3,000 million cubic meters. In other words, three times as much water would pass through the Raiyan Canal, as is claimed to be contained in the Assuan Reservoir, during the three months of short supply. More water would reach the Delta from the Raiyan Canal during the same period than through the Nile itself. The accompanying map shows the general shape and situation of the basin. Col. Western, Director-General of Works, favored a canal as indicated by a heavy black line, but the direct route, as shown in the Section, is only thirteen kilometers. This Section is the result of a special survey, in which pits were dug to ascertain the character of the soil and rock, for the Technical Commission on Reservoirs, of which the late Sir B. Baker and M. Boulé were distinguished members.*

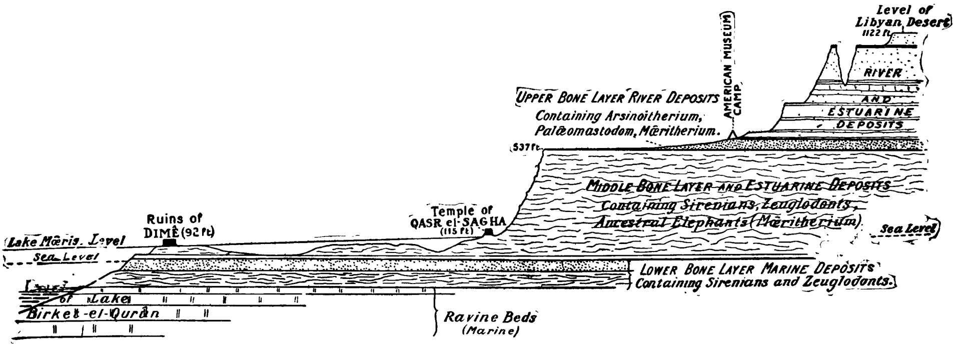
Level of Libyan Desert
1122 ft.
RIVER
AND
ESTUARINE
DEPOSITS
AMERICAN MUSEUM CAMP.
Upper Bone Layer River Deposits
Containing Arsinoitherium, Palæomastodom, Mœritherium.
537 ft.
Middle Bone Layer and Estuarine Deposits
Containing Sirenians, Zeuglodonts, Ancestral Elephants (Mœritherium)
Sea Level
Temple of QASR el-SAGHA (115 ft)
Ruins of DIMÊ (92 ft)
Lake Mœris. Level
Sea Level
Level of Lake Birket-el-Qurûn
Lower Bone Layer Marine Deposits
Containing Sirenians and Zeuglodonts.
Ravine Beds
(Marine)

FIG. 3—SECTION FROM THE BIRKET-EL-QURUN TO THE HIGH LEVEL OF THE LIBYAN DESERT.
From the "Century Magazine," October, 1907, by permission of Prof. Henry F. Osborn.

The results predicted from the Assuan Reservoir have not been realized. The pledge, which it was supposed rested upon the honor of the British Government, that Philæ would not be submerged, has been broken. It is now intended to raise the Dam by seven meters. It must be borne in mind that even had the Egyptian cotton crop shown a considerable increase, there has been a large diminution in cereals, and, more especially, in sugar and rice. Even in the Sudan, the water is husbanded, so that the peasants are no longer allowed to take water from the river for their own crop, as they had done from time immemorial.

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* See Official Reports of Proceedings, with the minority opinion of M. Boulé and the evidence of Mr. Cope Whitehouse against the Assuan Dam, Cairo, 1894.

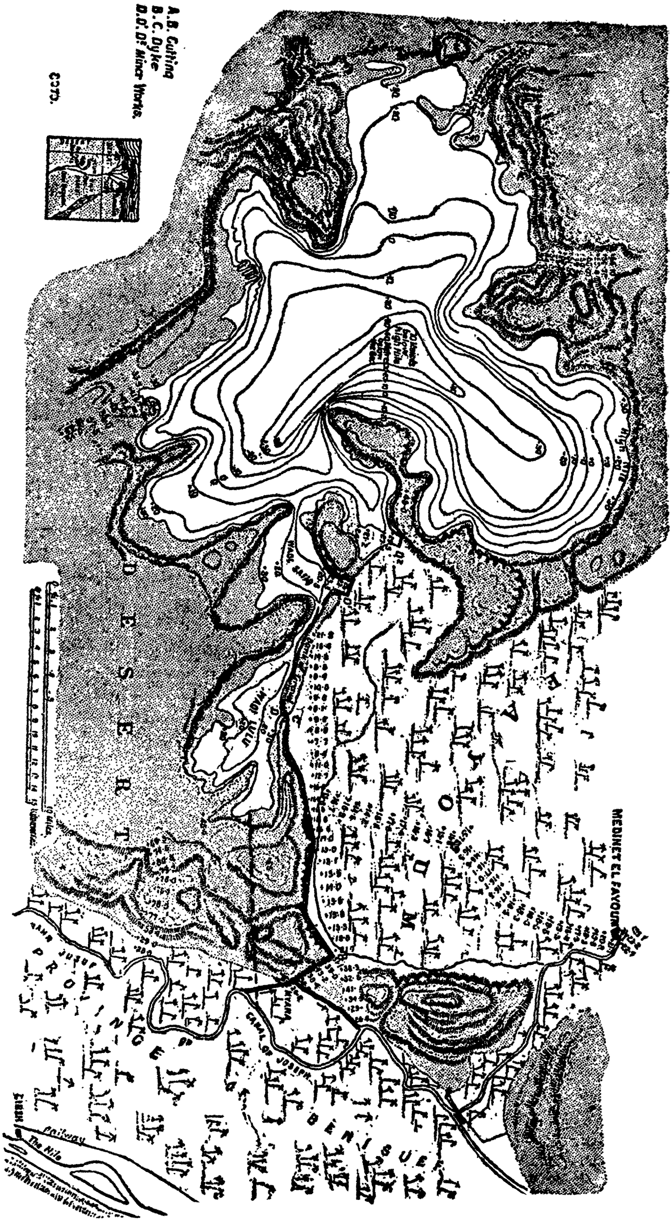

FIG. 4—RAIYĀN BASIN, DRAWN BY COPE WHITEHOUSE, 1888.

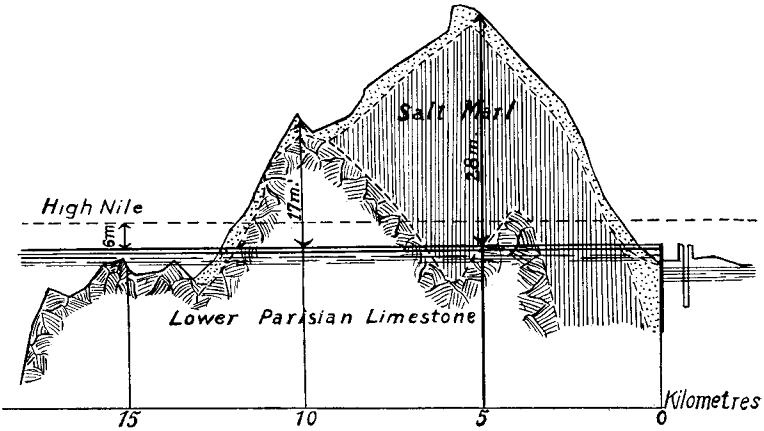

FIG. 5—WADI RAIYAN—THE RAIYAN ISTHMUS, NILE VALLEY.

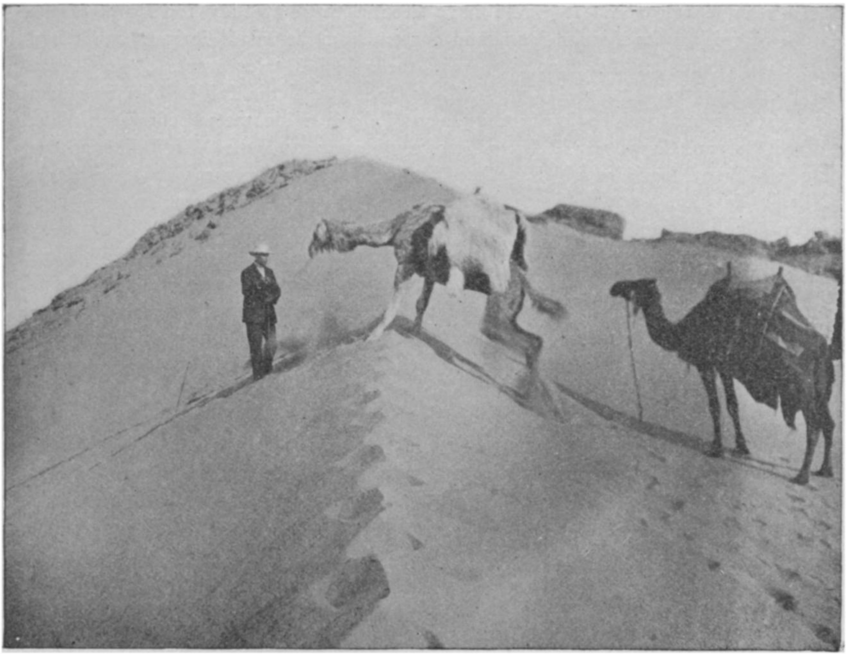

FIG. 6—SAND DUNE IN WADI RAIYAN, 100 FEET BELOW SEA-LEVEL.

From the "Century Magazine," October, 1907, by permission of Prof. Henry F. Osborn.

"Lecturing in this Hall in January, 1904, on the Assuan Dam and Lake Moeris," said Sir W. Willcocks,

"I stated that Egypt needed reservoirs capable of storing 4,000 million cubic meters of water, to supplement the summer supply of the river, and increase the Egyptian cotton crop from 6½ million of hundredweights to ten millions, and add $300,000,000 (£60,000,000) to the agricultural wealth of the country. I then stated that the Assuan reservoir actually contained 1,000,000,000 cubic meters of water; but that I had designed it capable of being raised another six meters, and storing an additional 1,000,000,000 cubic meters. That would have given us two billions; while the Wadi Raiyan reservoir could have given us the remaining 2,000,000,000, besides being able to bring appreciable relief to the country during a dangerous flood. I urged the construction of the Wadi Raiyan reservoir, as it would eventually have become the flood escape of the Nile, as soon as the river training and storage works on the White Nile had insured a sufficiency of summer water to Egypt. I concluded my lecture by saying, 'When the additional supplies from the upper waters of the White Nile had become so ample that it will be possible to dispense with the Wadi Raiyan as a reservoir, the Wadi with its canal will become the flood escape of Egypt like the ancient Lake Moeris, and Egypt, in the fullest meaning of the terms, will be enjoying perennial irrigation and flood protection.' Sir William Garstin approved of the raising of the Assuan Dam, which he said should not exceed in cost $2,500,000 (£500,000) but he did not recommend the present utilization of the Wadi Raiyan as a storage reservoir. It would have been a fortunate day for Egypt if the work of raising the Assuan Dam and constructing the Wadi Raiyan Canal had been undertaken at the same time with the splendid talus works down stream of the Dam; the Dam to-day would have been raised the full height for which it was designed and be impounding 2,000,000,000 cubic meters of water. The Wadi Raiyan Canal would have been completed; and the Wadi, like a true modern Lake Moeris, would have been ready to receive the surplus waters of the Nile in dangerously high floods. Egypt would have had its summer supply reserves doubled, and be free from the danger of an inundation. The money spent on the works would have been some of the best money Egypt had spent since King Amenemhat, four thousand years ago, made the ancient Lake Moeris and saved the country from the terrible evils of inundation. It was not, however, to be, and where do we stand to-day? The Assuan Dam is holding up its single billion of cubic meters of water; and works, which will take five or six years to complete, are being undertaken to raise the Dam seven meters and widen it five meters, so that it may hold up an additional 1,333 million cubic meters of water, at a cost of $5,500,000 (£1,100,000). The additional width of base of five meters is being built, not on a foundation designed and prepared for supporting a massive wall subjected to an ever-varying pressure, but on the apron, designed and constructed for insuring a safe flow of water along its surface. This patch-work addition of unhomogeneous masonry is to be tied by countless iron bars to the down-stream face of the main Dam. If the new work settles anywhere, as it may do, it is within the range of probability that it will tear off the face-work of the Dam, which face-work, as built, is itself unhomogeneous with the interior masonry of the Dam. I have tried in vain to fathom the reasons which led the late Sir Benjamin Baker, as Consulting Engineer to the Government, to advise the raising of the Dam by seven meters when he had resisted its being raised by six. The late Sir Benjamin Baker was a really big man, accustomed to very big things, and when he made a mistake he made a very big mistake, and Egypt is now paying $3,000,000 (£600,000) to cover that mistake. But the action deceives nobody, and all this foolish punching of holes and colossal waste of public money is a source of ridicule to the independent engineers of the country who know the history of the Dam."

GEOGRAPHICAL RECORD.

AFRICA.

WATER IN THE SAHARA.—While Civil Engineer David Levat was studying the metalliferous beds along the frontier in southeastern Morocco and southwestern Algeria (the region between Aïn Sefra, Shott Tigri and Figuig) he found impermeable rock under permeable strata (cretaceous sandstone). In view of the importance of water in the irrigation of the oases he endeavoured to ascertain the position of this impermeable level beneath the desert surface. The results were reported in the *Annales des Mines* (Jan., 1905) and reprinted (Dunod, Paris, 1905) under the title *Note sur la Reconnaissance d'un Niveau Aquifère dans le Sud-Oranais et dans le Sud-Marocain.* The study is of large practical as well as scientific value. It proves that the cretaceous belt, which extends along the northern edge of the desert and is about 120 miles wide, is underlain by a large supply of good water, which comes to the surface in some places and can everywhere be made available without much difficulty by means of comparatively shallow wells.

THE UPPER CURRENTS IN EGYPT.—The *Survey Notes* of the Egyptian Survey (No. 14, Nov., 1907) appropriately bear the legend, *Ex Africa semper aliquid novi,* for they contain a discussion, by B. F. E. Keeling, of "Upper Air Research at Helwan." Certainly it is something very new to find that a systematic campaign has now been undertaken to investigate the conditions of the free air in Egypt. Only pilot balloons have thus far been employed, Mr. Keeling noting that it is quite impracticable, in Egypt, to send up self-recording instruments, "as the balloons would almost invariably burst on the desert between the Nile and the Red Sea, or even further to the east, and the prospect of ever seeing them again would be extremely remote." The ascents in August and September, 1907, showed the following conditions: The trades were 900-2,000 meters thick. The transition area between trade and anti-trade was some 3,000 meters thick. The direction of the anti-trade was from west to southwest, the average direction being about west-southwest. Deviations from this general arrangement were common.

During September, the trade wind showed signs of becoming thicker, and the transition stage was more drawn out. On September 6 the westerly anti-trade came down to about 700 meters. On the 24th the anti-trade was not reached below 6,000 meters. On the 27th, although the surface wind was almost absent, the lower limit of the anti-trade was 3,000 meters high.

On the four days on which the observations reached 5,000 meters or more, the mean velocities for successive zones of 1,000 meters were 5.0, 7.0, 7.8, 10.2 and 9.0 meters per second, in ascending order. R. DeC. W.